

Answer the Following Questions:

Question 1 (20 Mark):

- (a) Why a compiler phases may be separated into front-end and back-end parts?
- (b) Show how each of the following source inputs can be optimized using global optimization techniques:
1. for (i=1; i<=10; i++)
 { x = i;
 y = x/2;
 a[i] = x;
 }
 2. if (x>0) x = 2;
 else if (x<=0) x = 3;
 else x = 4;

Question 2 (20 Mark):

- (a) What are the advantages and disadvantages of using linked lists, arrays, and binary search trees techniques for implementing symbol tables?
- (b) Show the binary search tree which would be constructed to store the following list of identifiers: sum, x3, count, x210, x, x33

Question 3 (20 Mark):

- (a) Show an example of a grammar rule which is:
1. Right Linear
 2. Context-Free, but not Right Linear
 3. Context-Sensitive, but not Context-Free
 4. Unrestricted, but not Context-Sensitive
- (b) Determine whether the following grammar is ambiguous. If so, show two different derivation trees for the same string of terminals, and show a left-most derivation corresponding to each tree.
1. $S \rightarrow a S b S$
 2. $S \rightarrow a S$
 3. $S \rightarrow c$

Question 4 (20 Mark):

- (a) Determine which of the following grammar is simple. For those which are simple, show an extended one-state pushdown machine to accept the language of that grammar.
1. $S \rightarrow a S b$
 2. $S \rightarrow b$
- (b) Show how to eliminate the left recursion from the grammar shown below:
1. $A \rightarrow A b c$
 2. $A \rightarrow a b$

Question 5 (20 Mark):

Assume that a shift/reduce parser always chooses the lower numbered rule whenever a reduce/reduce conflict occurs during parsing, and it chooses a shift whenever a shift/reduce conflict occurs. Show a derivation tree corresponding to the parse for the sentential form if Cond then if Cond then Stmt else Stmt, using the following ambiguous grammar. Since the grammar is not complete, you may have non-terminal symbols at the leaves of the derivation tree.

1. $\text{Stmt} \rightarrow \text{if (BoolExpr) Stmt else Stmt}$
2. $\text{Stmt} \rightarrow \text{if (Expr) Stmt}$

Answer the following five questions. Time allowed: 3 hours.

Question 1

- What is a data model? Discuss briefly its main types. Why is the *relational model*, in particular, the most widespread?
- List the advantages and disadvantages (if any) of a database management system (DBMS).
- The NULL values are adopted to solve the problem of incomplete information in relational models, but restrictions on the use of these NULLs do exist. Explain this statement with illustrative examples.

Question 2

- Prove mathematically that *every* relation has a key. Also differentiate between a key, superkey, primary key, and foreign key.
- Find the union, the intersection, and the two possible differences of the two relations of Fig.1, after appropriate renamings.
- In what sense are the selection and projection operators *complementary* to each other? For the relation PERSONNEL of Fig.1, find

$\Pi_{\text{Surname}} (\sigma_{\text{Income} \geq 2000} (\text{PERSONNEL}))$

MENAGEMENT

Surname	Branch	Wages
Safwat	Alexandria	2500
Nassar	Cairo	2500
Hamed	Tanta	2000
Safwat	Mansoura	2000

PERSONNEL

Surname	Factory	Income
Safwat	Alexandria	2500
Nassar	Cairo	2500
Hamed	Tanta	2000
Safwat	Mansoura	2000
Hashem	Alexandria	2100
Mostafa	Cairo	2100
Morad	Tanta	1800
Sallam	Mansoura	1800

Fig.1 Relations for Ques.2, parts (b) and (c)

Question 3

- Give a definition for the natural join of two relations. Show that this join can be simulated through three consecutive operations: renaming, equi-joining, and projection.
- Verify that the natural join of two relations with identical sets of attributes is the same as the intersection of the two relations, whereas the natural join of two relations with no attributes in common becomes a 'cartesian product' defined as the juxtaposition of a tuple from the first relation and a tuple from the second.
- Find the left, right, and full outer joins for the two relations of Fig.2.

STAFF

StaffMember	Department
Fawzy	Computers
Kamel	Computers
Amin	Industrial Control

CHAIRMANSHIP

Department	Chairman
Computers	Farouk
Neuroscience	Abdel Rahman

Fig.2 Relations for Ques.3, part (c)

Question 4

- (a) What does the acronym SQL stand for?
- (b) Write a short account on the families of SQL elementary domains that allow representation of time instants and time intervals.
- (c) Give a set of SQL commands that can construct a relation :

TRAINEE (ID, FirstName, Surname, Specialization)

with the following specifications:

- The attribute ID is a primary key, with domain char (10).
 - The attributes FirstName and Surname are each subject to a constraint *not null*, with domain char (20).
 - The attributes FirstName and Surname, taken together, are subject to a constraint *unique*.
 - The attribute Specialization, with domain char (15), refers to an attribute Career in another relation TRAINER, thus forming a foreign key.
 - The foreign key specified above has a correction policy *no action* for both deletions and updates.
- (d) Do the commands of part (c) belong to the data definition language (DDL) or data manipulation language (DML)? Why?
- (e) Modify the commands of part (c) so that the foreign key will have correction policies *set default* for deletions and *cascade* for updates.
- (f) What do the correction policies *no action* in part (c) and *set default* and *cascade* in part (e) mean?

Question 5

Consider the relation STUDENT given in Fig.3.

STUDENT

FirstName	Surname	Age	Faculty	Year
Adel	Helmy	20	Commerce	1
Alaa	Raafat	21	Engineering	2
Dina	Kamal	20	Science	2
Karim	Mostafa	22	Medicine	3
Noha	Abdel-Latif	20	Engineering	2
Salem	Mostafa	23	Medicine	4
Wael	Mostafa	21	Pharmacy	1
Zohdy	Saleh	22	Engineering	3

Fig.3 Relation for Ques.5

Write SQL instructions for the following queries, showing the result in each case:

- (a) Find the faculties of the students with surname Refaat. Rename the attribute Faculty as College.
- (b) Find the first names and surnames of the students enrolled in year 2 of the faculty of engineering.
- (c) Find the first names, surnames, and ages of the students enrolled in the faculty of engineering *or* the faculty of science.
- (d) Find the first names of the students with surname Mostafa *and* enrolled in the faculty of medicine *or* the faculty of pharmacy.
- (e) Find all available information of the students whose first names have an 'a' as the second letter and an 'm' as the last letter.

Answer the Following Questions:

Question 1 (14 Mark):

- A fair die is tossed, and the top face is observed. If the face is even, you win 1 L.E. otherwise you lose 1 L.E., what is the probability that you win?
- Given the following set of golf scores: $S = \{60, 69, 70, 72, 75, 77, 78, 84, 90\}$
 - Find the interquartile range for the data set.
 - Find the semiinterquartile range for the data set.

Question 2 (14 Mark):

- A class contains 10 boys and 20 girls of which half the boys and half the girls have brown eyes. Find the probability that a person chosen at random is a boy or has brown eyes?
- A die is tossed 100 times. The following table lists the six numbers and frequency with which each number appeared

Number	1	2	3	4	5	6
Frequency	14	17	20	18	15	16

Find the relative frequency f of the event:

- A 3 appears.
- A 5 appears.
- A prime number appears.
- An even number appears.

Question 3 (14 Mark):

- In a certain collage, 25% of the students failed mathematics, 15% of the students failed chemistry and 10% of the students failed both. A student is selected at random.
 - If he failed chemistry, what is the probability that he failed mathematics?
 - If he failed mathematics, what is the probability that he failed chemistry?
 - What is the probability that he failed mathematics or chemistry?
- A pair of fair die is tossed. Let x assigns to the sum of dices numbers. Calculate the mean, variance, and standard deviation of x ? [$x(a, b) = \text{sum}(a, b)$].

Question 4 (14 Mark):

- $F(x)$ is a distribution function and is given by:

$$F(x) = \begin{cases} 2x^2/5 & 0 \leq x \leq 1 \\ -3/5 + 2(3x - x^2/2)/5 & 1 \leq x \leq 2 \\ 1 & x \geq 2 \end{cases}$$

Find the density function $f(x)$?

- Let

$$f(x) = \begin{cases} x & 0 \leq x \leq 1 \\ (3-x)/4 & 1 \leq x \leq 3 \\ 0 & \text{elsewhere} \end{cases}$$

prove that $f(x)$ is a density function; then find the distribution function $F(x)$?

Question 5 (14 Mark):

- Consider the following binomial probability distribution:

$$P(x) = \binom{5}{x} (0.7)^x (0.3)^{5-x} \quad (x = 0, 1, \dots, 5)$$

where x is a random variable.

- How many trials (n) are in the experiment?
 - What is the value of p , the probability of success?
 - Graph $p(x)$.
 - Find the mean and standard deviation of x .
- Find the expectation μ , variance σ^2 , and the standard deviation σ for the following probability function:

$$P(x) = \begin{cases} 2x/25 & 0 \leq x \leq 5 \\ 0 & \text{elsewhere} \end{cases}$$

Course Title: Digital Signal Processing
Date: Jan 11, 2014 (First term)Course Code: CCE3116
Allowed time: 3 hrsYear: 3rd
No. of Pages: (2)**Remarks:** (answer the following questions... assume any missing data... answers should be supported by sketches...etc)**Problem number (1) (16 Marks)**

- a) State whether the following system is static, linear, shift invariant, causal, and stable.

$$y(n) = ax(n) + 5$$

(8 Marks)

- b) Consider a system with input
- $x(n]$
- and output
- $y(n]$
- that satisfy the difference equation:

$$y(n) = ny(n - 1) + x(n)$$

The system is causal and satisfies initial-rest conditions; i.e. if $x(n) = 0$ for $n < n_0$, then $y(n) = 0$ for $n < n_0$.

- i) If $x(n) = \delta(n)$, determine $y(n)$ for all n .
- ii) Is the system linear? Justify your answer.
- iii) Is the system time invariant? Justify your answer.

(8 Marks)

Problem number (2) (18 Marks)

- a) Determine the response of the system whose input and unit sample response are given as follows:

$$x(n) = u(n + 1) - u(n - 4) - \delta(n - 5)$$
$$h(n) = [u(n + 2) - u(n - 3)] \cdot (3 - |n|)$$

(7 Marks)

- b) Find the Z-transform and ROC of:

$$x(n) = nu(n - 1)$$

(6 Marks)

- c) Find the inverse Z-transform of the following function:

$$F(z) = \frac{z + 2}{(z - 0.6)(z^2 + 0.1z - 0.2)}$$

Is this function represents a stable system?

(5 Marks)

Problem number (3) (16 Marks)

- a) Determine N-point DFT for the following function:

$$x(n) = \cos\left(\frac{2n\pi}{N}\right)$$

(8 Marks)

- b) Determine 4-point DFT of the following sequence:

$$x(n) = \left\{ \begin{array}{c} 1, 2, 2, 1 \\ \uparrow \end{array} \right\}$$

(8 Marks)

Problem number (4) (20 Marks)

- a) A difference equation describing a digital system is given by:

$$y(n) + 0.5y(n-2) - 0.4y(n-3) = 0.5x(n-1) + x(n-2)$$

Find the system function and then draw direct form structure for this system.

(7 Marks)

- b) State the difference between the FIR filter and IIR filter?

(4 Marks)

- c) The system function of the analog filter is given by:

$$H(s) = \frac{s + 0.1}{(s + 0.1)^2 + 9}$$

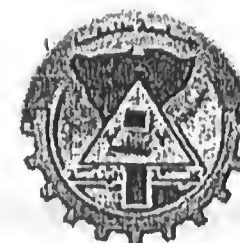
Find the system function of the IIR digital filter and then find the frequency response of the obtained digital filter?

(9 Marks)

Good Luck

Course Coordinator: Dr. Ahmed Elmogy

Time function	Laplace transform	Z-Transform
$\delta(t)$	1	1
$\delta(t - kT)$	e^{-kTs}	z^{-k}
$u(t)$	$\frac{1}{s}$	$\frac{z}{z-1}$
e^{-at}	$\frac{1}{s+a}$	$\frac{z}{z - e^{-aT}}$
T	$\frac{1}{s^2}$	$\frac{Tz}{(z-1)^2}$
t^2	$\frac{2}{s^3}$	$\frac{T^2 z(z+1)}{(z-1)^3}$

Course Title: Control Systems Engineering
Date: Jan. 4th, 2014Course Code: CCE3115
Allowed time: 3 HoursYear: 3rd Comp.
No. of Pages: 2

Remarks: You must show all of your work -- partial credit may be given to partially correct answers, while answers with no justification may not receive full points. Please attempt all questions.

Problem (1) (19 Marks)

a) The open-loop T.F. of a unity feedback control system of a printer drum is given as:

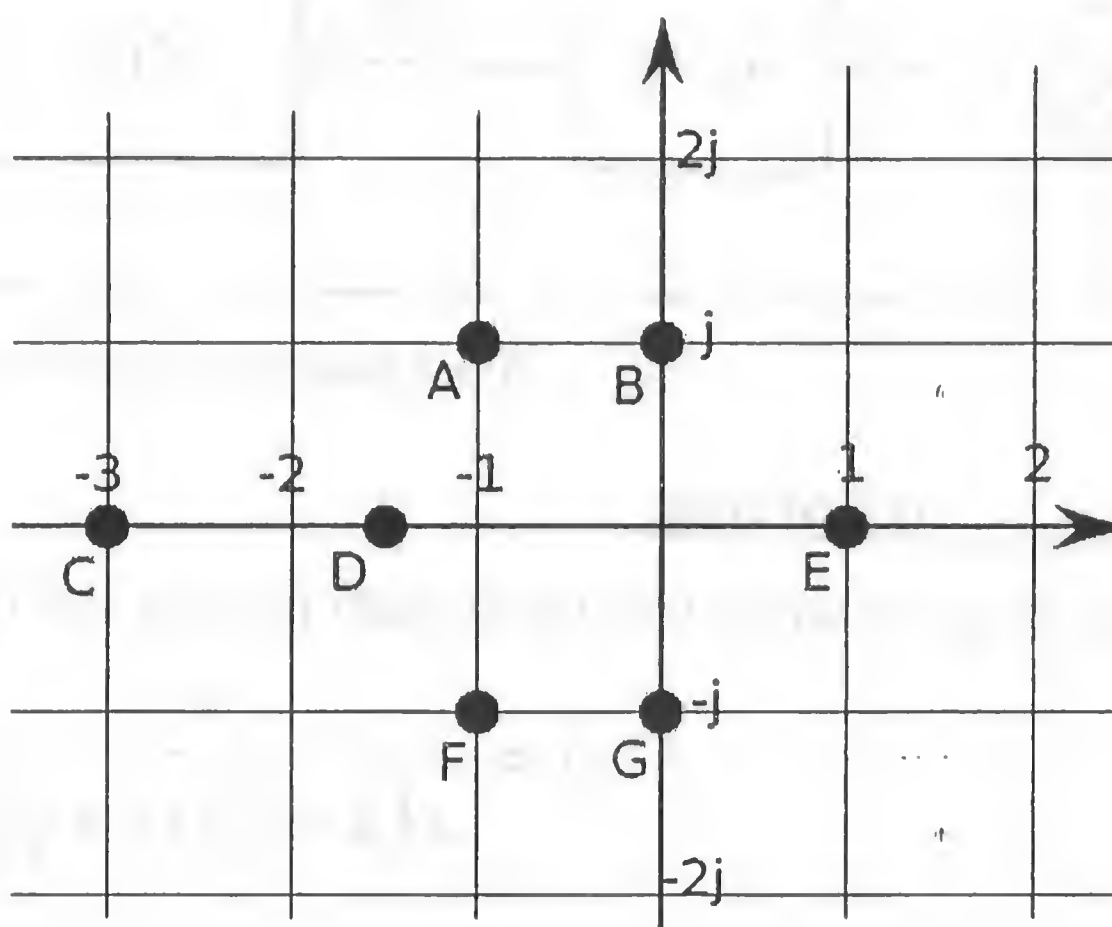
$$GH(s) = \frac{K}{s[(s+4)^2 + 16]}$$

- Sketch the root locus for the system as K varies from 0 to ∞ . **(12 Marks)**
- Calculate the gain K value corresponding to a damping ratio 0.5 **(3.5 Marks)**

b) Consider a unity-feedback system with the following forward transfer function:

$$G(s) = \frac{s^2 - 2s + 2}{(s+1)(s+2)}$$

For each of the labelled points below (A - G), state whether or not each point lies on the root locus. You must provide a justification for each point. Some points will require calculations to judge, while others can be ruled in or out by one or more of the sketching rules. Give your final answers in the form of a table. **(3.5 Marks)**

**Problem (2) (16 Marks)**

A unity feedback control system has an open loop transfer function as follows:

$$GH(s) = \frac{10}{(1+2s)(1+0.5s)(1+0.1s)}$$

- Sketch the polar plot for the system. **(2 Marks)**
- Sketch the Bode plots magnitude and phase for the system. **(10 Marks)**
- From the bode plots, determine the Gain Margin **GM**, Phase Margin **PM**, the phase crossover frequency ω_{pc} , and the gain crossover frequency ω_{gc} . **(2 Marks)**
- State whether the system is stable or not. **(2 Marks)**

Problem (3) (10 Marks)

The state-space representation of a tele-robot system is given by:

$$\dot{x}(t) = \begin{bmatrix} -1 & 0 \\ 1 & -2 \end{bmatrix} x(t) + \begin{bmatrix} 1 \\ 2 \end{bmatrix} u(t)$$
$$y(t) = [1 \quad 0] x(t)$$

- Calculate the gain matrix **K** of the state-feedback controller needed to place the closed-loop system poles at $-1 \pm j$ **(5 Marks)**
- Calculate the observer gain matrix **G** such that the observer will be critically damped and its poles are located at $-2, -2$ **(5 Marks)**

Problem (3) (15 Marks)

A conveyor belt system in an airport is modeled by the following transfer function:

$$G(s) = \frac{k}{s(s+3)(s+6)}$$

Design a suitable cascade compensator as in Fig.1 to meet the following specifications:

- The steady-state error to a unit ramp input must not exceed 10%
- The damping ratio of the dominant closed-loop poles is 0.5
- The dominant poles must have a real part less than or equal to -2

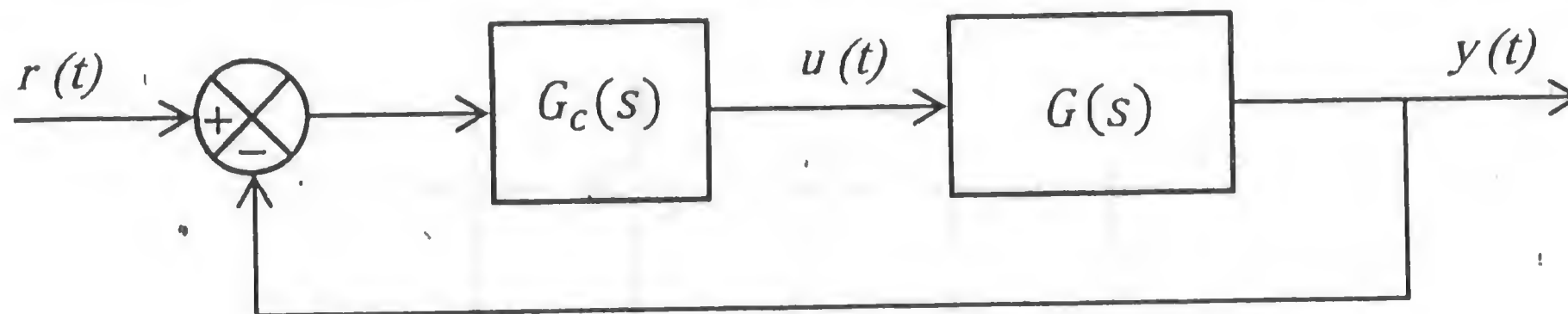


Fig. 1: Block diagram of problem 3

Problem (4) (15 Marks)

Design a compensating network for the system having the open loop transfer function:

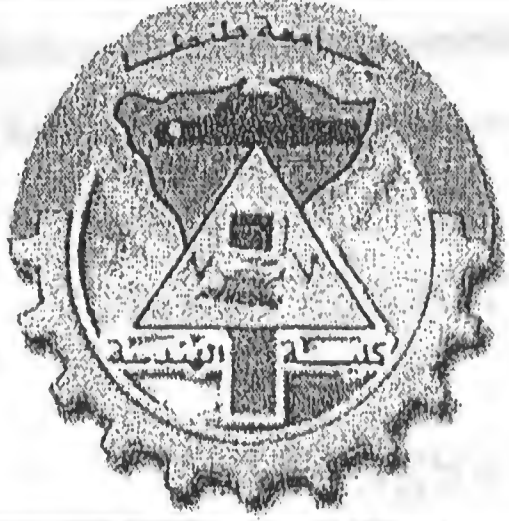
$$G(s) = \frac{k}{s \left(1 + \frac{s}{5}\right) \left(1 + \frac{s}{60}\right)}$$

to meet the following design requirements:

- The desired phase margin of the compensated system, $PM \geq 40^\circ$
- The steady-state error to a unit ramp input must not exceed 1%

Good Luck

Dr. Ahmed A. Ramadan



Course Title: **Operating Systems Concepts, 3rd Year**

Course Code: **CCE 3114**

Department: **Computers and Control Engineering**

Faculty of Engineering, Tanta University

Date: **18th January 2014, Allowed Time: 3 Hours**

Total Marks: **85 Marks, Exam in 3 Hours, Exam in 6 Pages**

- Answer ALL the Following Questions - 4 Qs.



- الامتحان من اربع اسئلة. يجب على جميع

Question One(20 Marks)

1. What are the Multiple Parts of a Process? Draw the Diagram of Process State.
2. Many Web browsers ran as a single process. Google chrome is multi-process with 3 different types of processes. Illustrate and discuss the advantages and disadvantages of Google chromes implementation.
3. Describe differences among short-term, medium-term, and long-term scheduling.
4. Describe the actions taken by a kernel to context-switch between processes.
5. What are the benefits and the disadvantages of each of the following?
 - a. Synchronous and asynchronous communication
 - b. Automatic and explicit buffering
 - c. Send by copy and send by reference
 - d. Fixed-sized and variable-sized messages
6. How does the distinction between kernel mode and user mode function as a rudimentary form of protection (security) system?
7. Provide three programming examples in which multithreading provides better performance than a single-threaded solution.
8. What are two differences between user-level threads and kernel-level threads? Under what circumstances is one type better than the other?
9. Describe the actions taken by a kernel to context-switch between kernel-level threads.
10. What resources are used when a thread is created? How do they differ from those used when a process is created?

Question Two(20 Marks)

1. What are the Multiple Parts of a Process? Draw the Diagram of Process State.
2. What are the three major activities of an operating system with regard to secondary-storage management?
3. What is the purpose of the command interpreter? Why is it usually separate from the kernel?
4. What system calls have to be executed by a command interpreter or shell in order to start a new process?
5. What is the purpose of system programs?
6. Amdahl's Law is shown below. Discuss why we need this law. Using the law, if an application is 50% parallel / 50% serial, moving from 1 to 4 cores, identify the result in speedup.

$$\text{speedup} \leq \frac{1}{S + \frac{(1-S)}{N}}$$

7. Is disk scheduling, other than FCFS scheduling, useful in a single-user environment? Explain your answer.
8. Explain why SSTF scheduling tends to favor middle cylinders over the innermost and outermost cylinders.
9. Why is it important to balance file system I/O among the disks and controllers on a system in a multitasking environment?
10. Given a request queue (98, 183, 37, 122, 14, 124, 65, 67) where Head pointer is 53. Compare with illustrating figures between the following Disk Scheduling Algorithms: FCFS, SSTF, SCAN, C-SCAN, C-LOOK, highlighting advantages and disadvantages of each of them. What is the most common used one?

Question Three(20 Marks)

1. Why do some systems keep track of the type of a file, while others leave it to the user and others simply do not implement multiple file types? Which system is "better?"

2. Similarly, some systems support many types of structures for a file's data, while others simply support a stream of bytes. What are the advantages and disadvantages of each approach?
3. Explain the purpose of the open() and close() operations.
4. Researchers have suggested that, instead of having an access list associated with each file (specifying which users can access the file, and how), we should have a user control list associated with each user (specifying which files a user can access, and how). Discuss the relative merits of these two schemes.
5. Describe the three types of traditional virtualization.
6. Describe the four virtualization-like execution environments and why they are not "true" virtualization.
7. Describe four benefits of virtualization.
8. Why is live migration possible in virtual environments but much less possible for a native operating system?

Question Four.....Chose the Correct Answer.....(25 Marks)

1. What is Ubuntu Linux?
 - a. Computer operating system based on Microsoft Windows kernel and Microsoft tools and libraries.
 - b. Computer operating system based on Linux kernel, GNU tools and libraries.
 - c. Computer software based on Xbox game engine.
 - d. Computer operating system based on Android OS.
 - e. Computer operating system based on Ubuntu kernel, GNU tools and libraries.
2. Open Source Software is software that we can:
 - a. See its source code and use it for free
 - b. See its source code but we have to buy it
 - c. See its source code and may be we can use it for free
 - d. Not see its source code and we can not use it for free
3. What is the user credentials needed for the login process:
 - a. User ID and Password
 - b. User username and password
 - c. User group ID and Password
 - d. User Password Only
4. What is the Shell?
 - a. Software provides a backdoor to the users to crack their passwords

- b. Software that provides an interface to the users and allows communication with other computers systems
 - c. Software provides an interface to the users and allows browsing the internet
 - d. Software provides an interface to the users and Allowing communicate with the kernel of operating system
5. Command pwd is used to
- a. Show us the working directory for the web server
 - b. Show us the working directory for current working directory
 - c. Show us the date
 - d. Show us the date for next day
6. cd command to
- a. Change our working directory
 - b. Change the date
 - c. Find Help
 - d. Connect Wirelessly
 - e. Change directory to a file system
7. What does this command do \$ls -a
- a. Shows us the hidden files only
 - b. Shows us the hidden files and the normal files only
 - c. Shows us the hidden directories only
 - d. Shows us both hidden and unhidden directories and files
8. What is the result of: \$mkdir /home/test/OS
- a. Creates folder OS in home directory
 - b. Creates file OS in test directory
 - c. Creates directory OS in test directory
 - d. Creates file OS in home directory
9. What is the result of \$touch test.txt :
- a. Updates test.text timestamp and make it empty
 - b. Creates test.text if it doesn't exist or updates its timestamp if it is exists without deleting its content
 - c. Creates test.text if it doesn't exist or updates its timestamp if it exists with deleting its content
 - d. Creates test.text if it doesn't exist or deletes its content
10. What is the result of \$sudo apt-get install ipython:
- a. Installs the ipython without downloading it from the internet
 - b. Connects to the internet to bring ipython and installs it
 - c. Installs ipython as an interface program
 - d. Installs ipython to work with integration of libreOffice
11. What is the importance of sudo in the command: \$sudo apt-get install vim:
- a. Makes the commands run with root user privileges
 - b. Makes the command runs quickly
 - c. Gives credentials to connect to the internet
 - d. Makes commands run powerfully

12. What does this command needs as an input `$sudo apt-get install vim`:
- Root user password and internet connection
 - Root user ID and wifi connection
 - Root user group ID and DSL link
 - System password and TE-Data account
13. Commands have the following syntax:
- Command arguments options
 - Command options arguments
 - Options only
 - Options command arguments
14. What does the options do for the command?
- Modify a command's behavior
 - Modify a command's speed
 - Modify a command's clock
 - Modify a command's name
15. Which is the absolute path in these paths ?
- `/home/gio/test.text`
 - `home/gio/ktext`
 - `../gio/g.text`
 - `a/b`
 - `test.txt`
16. What does this command do? `$cd ..`
- Go to the home directory
 - Go to the parent directory
 - Go to the previous directory
 - Go to the root directory
17. What does this command do? `$$$cd`
- Go to the home directory
 - Go to the parent directory
 - Go to the previous directory
 - Go to the root directory
18. What does this command do? `$cd -`
- Go to the home directory
 - Go to the parent directory
 - Go to the previous directory
 - Go to the root directory
19. What does this command do? `$ls -R` :
- List all the directories recursively
 - List the parent directory
 - Show us the dates of the files
 - Show us the hidden files
20. What does this command do? `$cp test.cpp test.txt /home/user`
- Copy test.cpp to user directory

- b. Copy both of test.txt and test.cpp to user directory
 - c. Copy both of test.txt and test.cpp to home directory
 - d. Copy random file from test.cpp and test.txt
21. What does this command do? `$cp test.cpp /home/user/test.txt` :
- a. Copy test.cpp to user directory without changing its name
 - b. Copy test.cpp to home directory and change its name to test.txt
 - c. Copy test.cpp to user directory and change its name to test.txt
 - d. Copy test.txt to user directory and change its name to test.cpp
22. What does this command do? `$mv test.cpp /home/user/test.txt` :
- a. Moves test.cpp to user directory without changing its name
 - b. Moves test.cpp to home directory and change its name to test.txt
 - c. Moves test.cpp to user directory and change its name to test.txt
 - d. Moves test.txt to user directory and change its name to test.cpp
23. What does this command do? `$sudo rm -rf /`
- a. Removes all data in the system
 - b. Removes all empty files in the system
 - c. Removes all data in home directory
 - d. Removes root's data
24. Every file has:
- a. Only one owner and one group
 - b. Only one owner but multiple group
 - c. Multiple owner but only one group
 - d. Multiple owners and groups
25. Every User has:
- a. Only one user ID and one group
 - b. Only one User ID and joined multiple groups
 - c. Multiple IDs and groups
 - d. Only one group with password

*Best Wishes,
Dr.Haitham A. El-Ghareeb*